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Diel Feeding and Gastric Evacuation of Juvenile Salmon



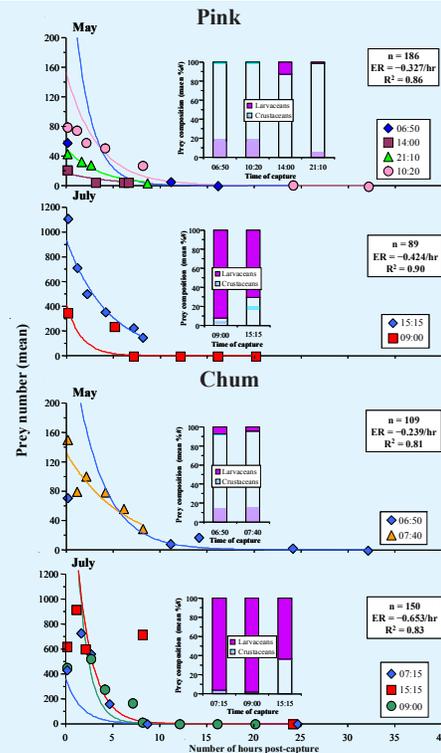
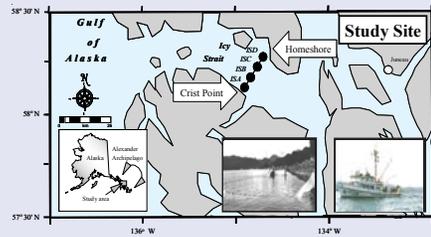
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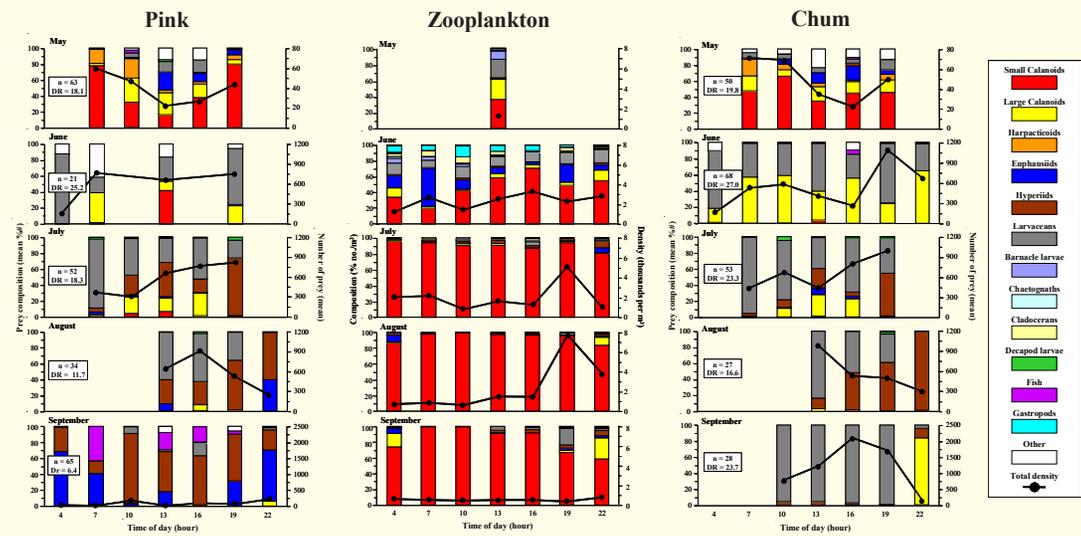


Introduction

We studied seasonal diel feeding rhythms and gastric evacuation rates of juvenile pink (*Oncorhynchus gorbuscha*) and chum (*O. keta*) salmon in Icy Strait in the northern region of southeastern Alaska, May through September of 2001. These process studies were conducted as part of the **Southeast Coastal Monitoring (SECM) Project** of the Auke Bay Laboratory, NMFS. For each of the past seven years (1997-2003), SECM has monitored the abundance, distribution, stock composition, and carrying capacity of juvenile salmon, as well as their trophic ecology and habitat biophysical parameters, as they transit through the principal migration corridor in the region. Fish were collected by beach seining in May and surface trawling, at a station 6.4 km offshore, in June through September. Zooplankton samples were collected concurrently. All samples were later analyzed in the lab.



Exponential Evacuation Rates: decline in # of prey over time, with prey composition (mean % # of hard- or soft-bodied taxa, bar graph) at time of capture, in May and July, for juvenile pink and chum salmon; # of fish (n) and R² shown.



Diel Feeding Rhythm: Monthly diel prey composition (mean % #) and mean total # of prey of juvenile pink and chum salmon, with 20-m zooplankton (double oblique bongo, 333-µm mesh) composition (mean % #) and density (thousands per m³); # of fish (n) and daily rations (DR, wet % body weight) shown.

Objectives and Methods

Diel Feeding Rhythm

- Stomach analysis at 7 intervals/24-hr day, May-Sept.
- Fullness indices (% full and wet % body weight, BW)
- Prey composition (mean % #)
- Compare with zooplankton density (total #/m³) and composition (mean % # by taxon)

Exponential Evacuation Rate (ER)

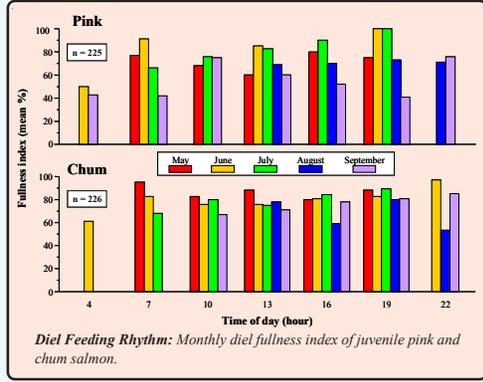
- Rate of food passage through stomach over time, May and July

Daily Ration (DR)

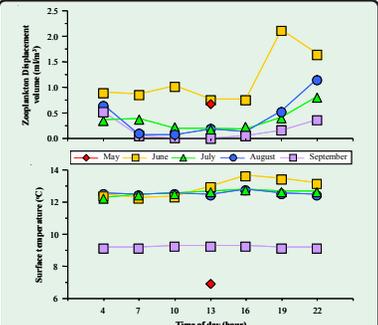
- Mean daily food consumption by month:
 $C = 24 \cdot BW \cdot ER$
- Used ERs specific to monthly prey composition

Habitat Biophysical Parameters

- 20-m zooplankton volumes (ml/m³)
- 2-m surface temperatures (°C)



Diel Feeding Rhythm: Monthly diel fullness index of juvenile pink and chum salmon.



Habitat Biophysical Parameters: monthly diel zooplankton displacement volumes (ml/m³) and 2-m surface temperatures (°C).

Conclusions

- #### Diel Feeding Rhythm and Daily Ration
- Juvenile salmon fed continuously throughout the day, usually with 60-95% mean stomach fullness per diel period; however, prey #s in the guts were highest early and late in the day.
 - Fullness and daily ration peaked in June, coincident with peak zooplankton densities and volumes.
 - Small calanoids dominated the zooplankton except in May and June, the only time they were prominent in the diets.
 - Prey composition changed seasonally and included large calanoids, euphausiid larvae and juveniles, hyperiid juveniles, and larvaceans, but no consistent diel patterns were observed.
- #### Exponential Evacuation Rate (ER)
- From May to July, ER increased, and time to empty stomachs decreased (from 12 to 8 hours), when:
- Prey changed from hard-bodied taxa to soft-bodied taxa
 - Total # of prey at time of capture was much higher
 - Fish size was much larger
 - Temperature increased greatly.
- #### Habitat Biophysical Parameters
- Seasonal temperatures peaked in June at >13°C, coincident with peak zooplankton volumes and densities.
 - Diel temperature changes were minimal, but zooplankton volume peaked late in the day each month.